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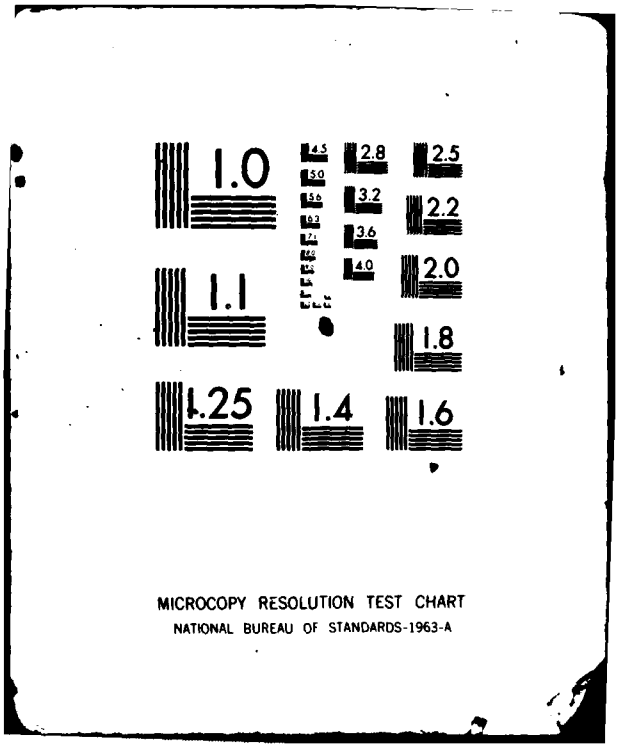
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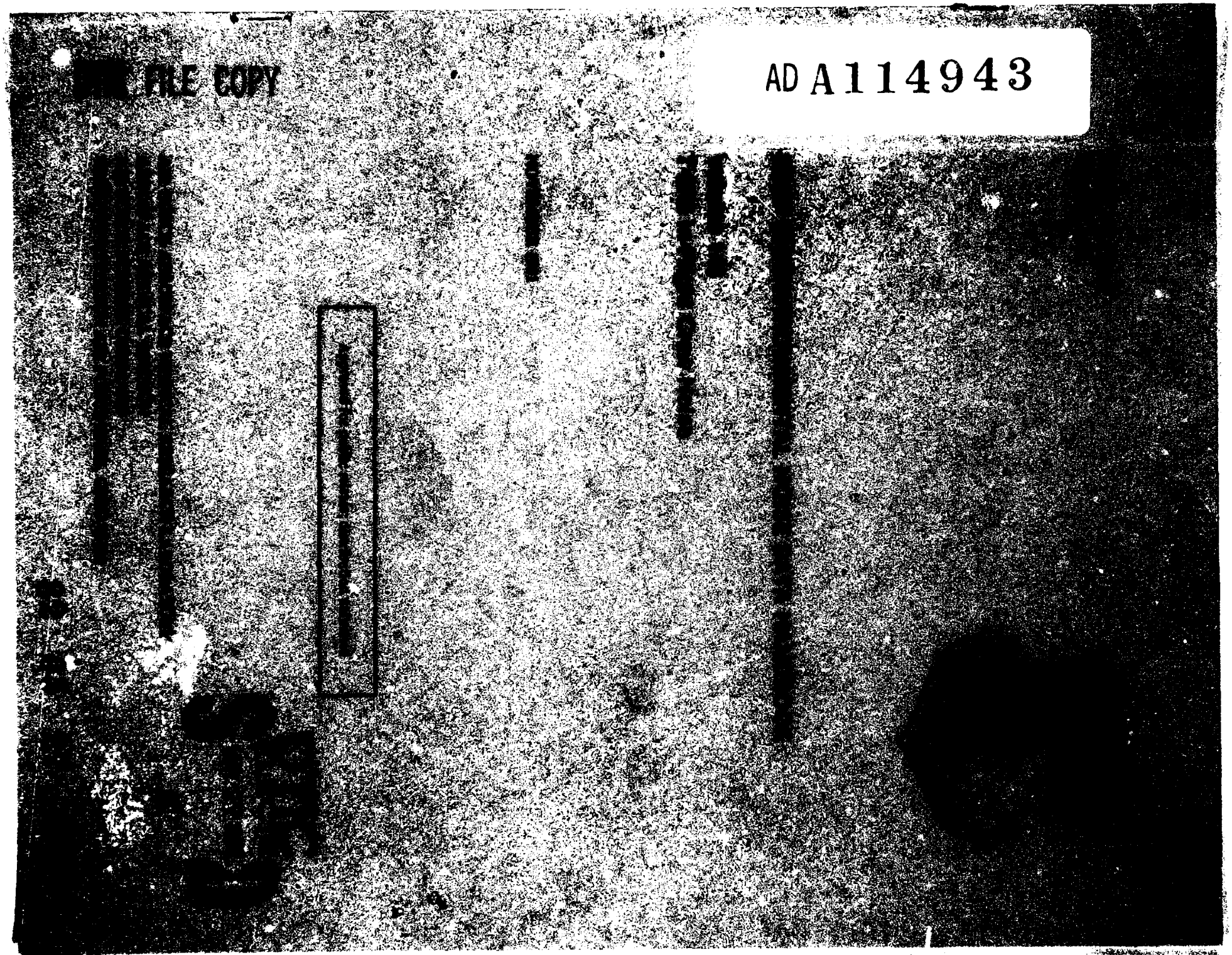

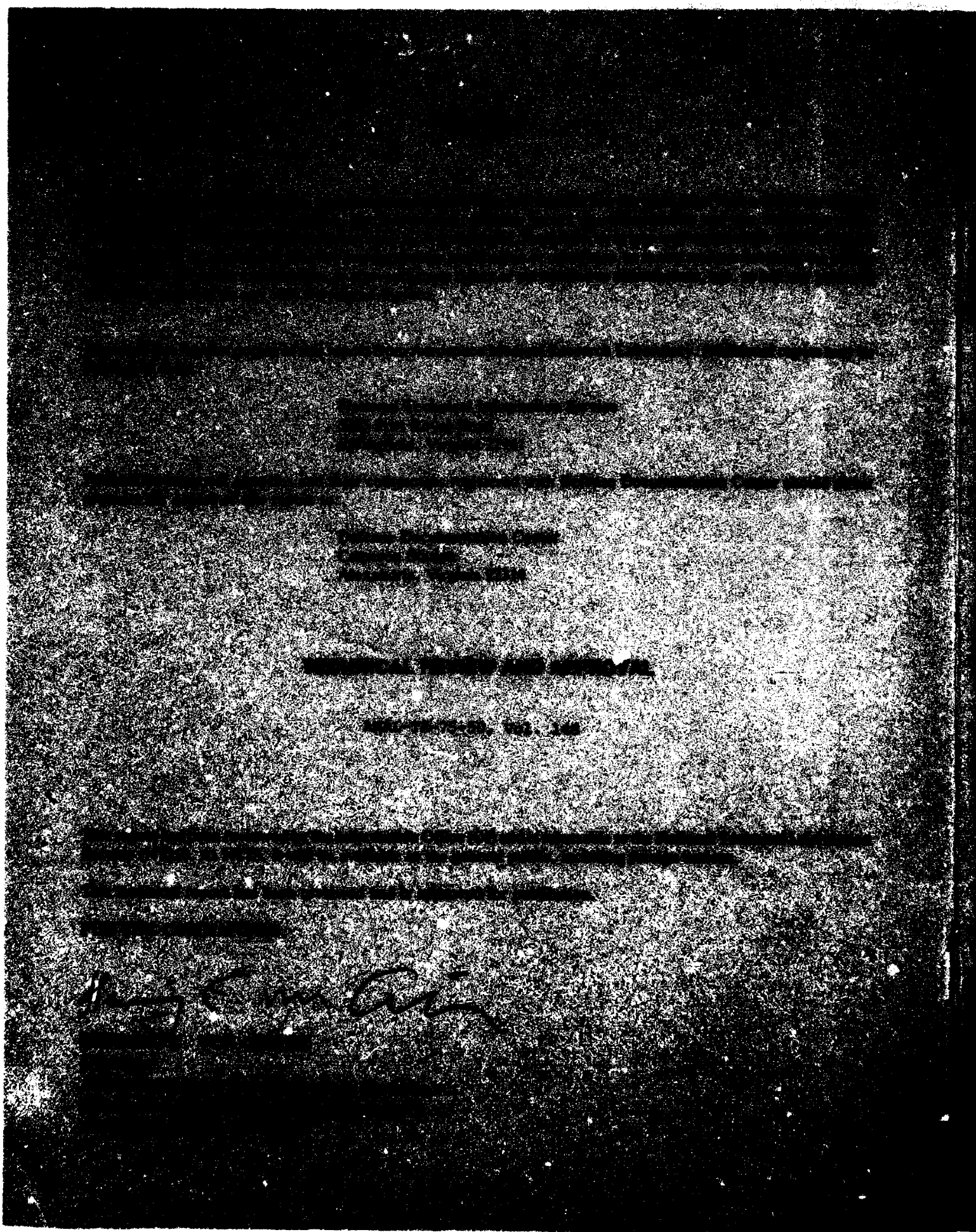

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The T-37B is a USAF two-seat primary trainer aircraft. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported at one location for 19 different flight conditions and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and

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without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application," AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

PREFACE

This report was prepared by the Biodynamic Environment Branch, Air Force Aerospace Medical Research Laboratory, under Project/Task 723108, Crew Safety In Operational Noise Environments.

The author acknowledges the efforts of Mr. John N. Cole who established the data analysis requirements, Mr. Henry Mohlman and Mr. Fred Lampley of the University of Dayton who assisted in the mechanics of data processing and Mrs. Norma Peachey who typed this report and prepared it for publication.

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INTRODUCTION

The T-37B is a USAF two-seat primary trainer aircraft manufactured by the Cessna Aircraft Company, Wichita, Kansas. Power is provided by two Continental J-69-T-25 turbojet engines each rated at 1025 lbs. maximum takeoff thrust. The engines are manufactured by Teledyne CAE, Toledo, Ohio.

This volume provides measured data defining the bioacoustic environments produced inside the aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the T-37B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentations, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; AUTOVON 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application,* AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

IN-FLIGHT NOISE

Measurements

All noise measurements were made on-board a T-37B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard T-37B environments but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made inside the cockpit at the pilot's location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A, etc.

The microphone was attached to the pilot's helmet by means of a lightweight boom. This arrangement enabled adjustment of the microphone close to the ear level at a distance of 0.1 meter with its diaphragm parallel and facing away from the helmet's surface. In the analysis, microphone corrections for random incidence were applied to the overall systems response. The recorded samples were analyzed using a four or eight second integration time to obtain a power-averaged level which effectively smooths out short duration fluctuations and best describes the exposure.

Results

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the T-37B aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1
MEASUREMENT LOCATION AND TEST CONDITIONS
T-37B, WRIGHT-PATTERSON AFB, OH; 6 AUG 81
SER NO. 00141

Location	Position	Height Above Deck
1	Co-Pilot	Seated Head Level

Condition	Description
A	Engines Idle, Canopy Closed ECS ON, 39% RPM
B	Engines Idle, Canopy Closed, ECS OFF, 39% RPM
C	Engines Idle, Canopy Open, 39% RPM
D	Engines Military, Canopy Closed, ECS ON, 80% RPM
E	Engines Military, Canopy Closed, ECS OFF, 80% RPM
F	Taxi
G	Takeoff
H	Climb to 6,000 ft
I	Cruise 6,000 ft, 220 KIAS, 95% RPM
J	Climb to 20,000 ft, 160 KIAS, 99% RPM
K	Cruise at 20,000 ft, 205 KIAS, 98% RPM, ECS ON
L	Cruise at 20,000 ft, 205 KIAS, 99% RPM, ECS OFF
M	Start of Descent to 10,000 ft
N	Descend to 10,000 ft, at 17,000 ft, speed brakes out
O	Descend to 10,000 ft, at 13,000 ft, speed brakes up
P	Cruise at 10,000 ft, 190 KIAS, 85% RPM, ECS ON
Q	Cruise at 10,000 ft, 190 KIAS, 85% RPM, ECS OFF
R	Descend to 6,000 ft
S	Landing Roll

TABLE: 2 MEASURED SOUND PRESSURE LEVEL (DB)
1/3 OCTAVE BAND

IDENTIFICATION:
OMEGA 3.2
TEST BH-001-081
RUN 01
09 NOV 81
PAGE F1

NOISE SOURCE/SUBJECT:
T-37B AIRCRAFT
IN-FLIGHT NOISE LEVEL

OPERATION:

FREQ (HZ)	LOCATION/CONDITION 1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J
25	83	84	88	80	83	86	83	76	76	74
31.5	76	79	84	76	79	79	81	74	76	73
40	76	77	87	76	79	83	81	77	77	74
50	81	81	92	78	79	85	84	79	79	75
63	78	77	82	86	84	77	99	96	85	88
80	82	82	84	88	88	79	100	99	88	91
100	85	85	85	89	88	79	95	94	89	90
125	93	94	88	92	92	82	96	93	90	89
160	87	87	84	89	89	83	92	88	86	85
200	90	89	86	92	92	82	96	95	93	92
250	94	93	94	98	98	89	104	99	95	97
315	90	98	88	97	97	85	104	101	98	99
400	93	93	88	95	95	84	104	101	95	97
500	94	94	89	93	93	86	100	99	95	95
630	90	90	90	89	89	86	96	95	93	92
800	87	88	90	88	87	85	95	93	90	91
1000	89	89	88	87	86	83	97	96	91	92
1250	88	87	89	88	89	84	95	94	90	90
1600	86	85	88	86	85	82	92	90	87	87
2000	99	98	102	83	83	89	89	88	84	84
2500	97	96	102	81	81	97	86	86	82	83
3150	79	80	81	80	79	80	84	84	81	80
4000	81	81	84	85	85	78	84	83	82	80
5000	79	79	83	91	92	79	85	85	87	80
6300	80	80	84	77	78	74	88	90	81	85
8000	74	75	79	77	78	72	79	78	77	75
10000	71	72	75	83	84	68	79	79	78	75
OVERALL	105	104	106	104	104	100	111	109	105	105

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: 2 MEASURED SOUND PRESSURE LEVEL (DB)
1/3 OCTAVE BAND

IDENTIFICATION:
OMEGA 3.2
TEST 8H-001-081
RUN 02
09 NOV 81
PAGE F2

NOISE SOURCE/SUBJECT:
T-37B AIRCRAFT
IN-FLIGHT NOISE LEVEL

OPERATION:

FREQ (HZ)	LOCATION/CONDITION 1/K	1/L	1/M	1/N	1/O	1/P	1/Q	1/R	1/S
25	72	76	84	89	75	76	78	79	91
31.5	70	76	85	87	74	74	77	77	84
40	72	76	85	89	74	74	77	77	88
50	75	78	83	84	74	77	80	78	90
63	84	83	93	93	82	83	87	84	82
80	84	83	95	96	81	85	87	84	84
100	85	85	91	94	83	86	85	84	84
125	85	88	91	94	88	89	85	86	88
160	84	85	89	89	84	85	83	85	88
200	90	90	97	97	90	91	92	92	87
250	91	92	95	96	91	95	94	92	94
315	98	99	94	96	92	96	95	93	90
400	98	97	93	93	90	92	92	92	89
500	92	92	90	92	90	93	93	91	91
630	89	90	88	88	88	90	90	90	91
800	88	89	86	87	87	88	86	85	91
1000	88	89	85	87	87	89	86	87	88
1250	86	87	83	85	85	88	86	86	89
1600	84	85	81	83	83	85	85	85	88
2000	81	83	79	81	80	82	82	82	95
2500	79	80	79	80	80	80	80	83	103
3150	78	78	80	83	84	79	77	88	85
4000	78	79	82	79	80	82	80	83	82
5000	75	77	75	76	77	89	87	79	84
6300	79	78	76	75	76	77	76	78	80
8000	73	72	71	71	72	74	73	74	77
10000	71	73	67	68	69	75	77	70	73
OVERALL	103	103	104	105	100	103	102	101	106

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: 2 MEASURED SOUND PRESSURE LEVEL (DB) OCTAVE BAND

IDENTIFICATION:
OMEGA 3.2
TEST BH-001-081
RUN 01
09 NOV 81
PAGE J1

NOISE SOURCE/SUBJECT:
T-37B AIRCRAFT
IN-FLIGHT NOISE LEVEL

OPERATION:

FREQ (HZ)	LOCATION/CONDITION 1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J
31.5	84	86	91	82	85	88	86	81	81	78
63	85	85	93	90	90	86	103	100	90	93
125	94	95	91	95	94	86	100	97	93	93
250	96	96	95	101	101	91	107	104	101	101
500	97	97	94	98	98	90	105	104	99	100
1000	93	93	94	92	92	89	100	99	95	96
2000	101	100	105	88	88	98	94	93	90	90
4000	85	85	88	92	93	84	89	89	89	85
8000	82	81	85	85	86	77	89	90	84	85
OVERALL	105	104	106	104	104	100	111	109	105	105

TABLE: 2 MEASURED SOUND PRESSURE LEVEL (DB) OCTAVE BAND

IDENTIFICATION:
OMEGA 3.2
TEST BH-801-081
RUN 02
09 NOV 81
PAGE J2

NOISE SOURCE/SUBJECT:
T-37B AIRCRAFT
IN-FLIGHT NOISE LEVEL

OPERATION:

FREQ (HZ)	LOCATION/CONDITION 1/K	1/L	1/M	1/N	1/O	1/P	1/Q	1/R	1/S
31.5	76	81	89	93	79	79	82	83	93
63	87	87	97	98	85	87	90	88	92
125	90	91	95	97	90	92	89	90	91
250	99	100	100	101	96	99	99	97	96
500	99	99	95	96	94	97	97	96	95
1000	92	93	89	91	91	93	91	91	94
2000	87	88	84	86	86	87	87	88	103
4000	82	82	84	85	86	90	88	89	88
8000	80	80	77	77	78	80	80	80	82
OVERALL	103	103	104	105	100	103	102	101	106

TABLE: 3 MEASURES OF HUMAN NOISE EXPOSURE

IDENTIFICATION:
OMEGA 3.2
TEST BH-001-881
RUN 01
09 NOV 81
PAGE H1

NOISE SOURCE/SUBJECT: T-37B AIRCRAFT IN-FLIGHT NOISE LEVEL

OPERATION:

	LOCATION/CONDITION									
	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J
HAZARD/PROTECTION										
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR										
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR										
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)										
NO PROTECTION										
OASLC	104	104	106	104	104	100	111	109	104	105
OASLA	104	103	107	100	100	100	106	104	101	101
T	15	16	9	30	30	30	11	15	25	25
HGU-2A/P HELMET WITH H-154										
OASLA*	90	89	88	93	93	84	99	96	93	93
T	170	202	240	101	101	480	36	60	101	101
HGU-2A/P HELMET WITH H-154(A)										
OASLA*	85	85	84	89	89	80	96	92	89	90
T	404	404	480	202	202	960	60	120	202	170
HGU-2A/P HELMET WITH CUSTOM LINER										
OASLA*	95	95	95	96	96	89	103	101	97	98
T	71	71	71	60	60	202	18	25	50	42
COMMUNICATION										
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)										
PSIL	97	97	97	93	93	92	100	99	95	95
ANNOYANCE										
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)										
TONE CORRECTION (C IN DB)										
PNLT	119	119	123	118	117	119	120	119	115	114
C	3	3	3	3	3	4	1	2	2	1

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE: MEASURES OF HUMAN NOISE EXPOSURE

3

IDENTIFICATION:
OMEGA 3.2
TEST BH-001-081
RUN 02
09 NOV 81
PAGE H2

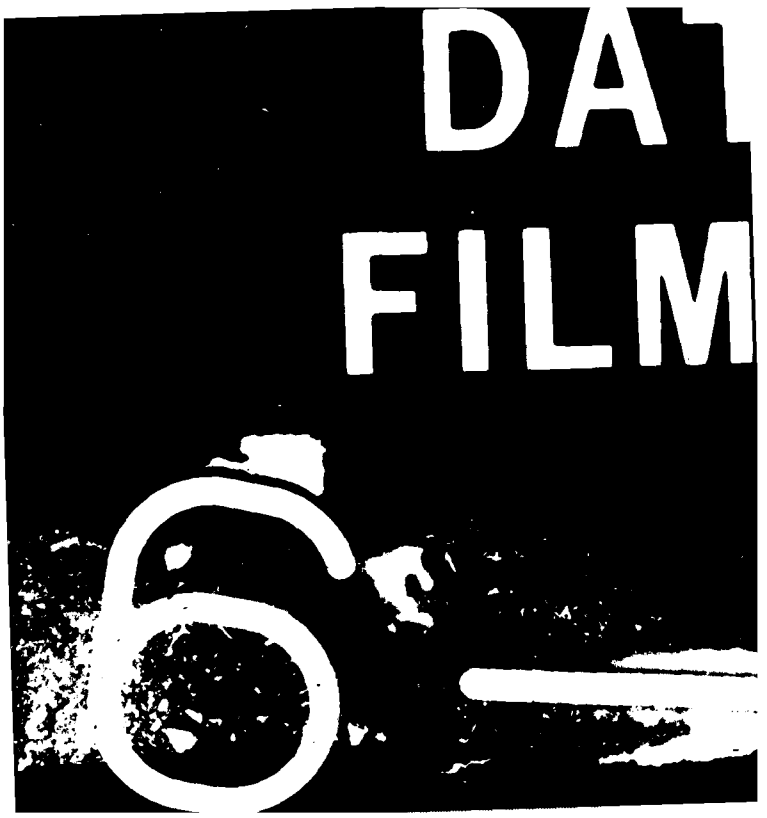
NOISE SOURCE/SUBJECT:
T-37B AIRCRAFT
IN-FLIGHT NOISE LEVEL

OPERATION:

	LOCATION/CONDITION								
	1/K	1/L	1/M	1/N	1/O	1/P	1/Q	1/R	1/S
HAZARD/PROTECTION									
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR									
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR									
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)									
NO PROTECTION									
OASLC	103	103	104	105	100	103	102	101	105
OASLA	99	99	97	98	96	99	98	98	105
T	36	36	50	42	60	36	42	42	13
HGU-2A/P HELMET WITH H-154									
OASLA*	92	92	92	92	88	91	90	89	89
T	120	120	120	120	240	143	170	202	202
HGU-2A/P HELMET WITH H-154(A)									
OASLA*	88	88	88	88	84	87	86	85	85
T	240	240	240	240	480	285	339	404	404
HGU-2A/P HELMET WITH CUSTOM LINER									
OASLA*	95	96	94	95	92	95	94	93	95
T	60	60	85	71	120	71	85	101	71
COMMUNICATION									
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)									
PSIL	93	93	90	91	90	92	92	92	97
ANNOYANCE									
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)									
TONE CORRECTION (C IN DB)									
PNLT	112	113	112	112	111	115	114	113	124
C	1	1	1	1	1	3	3	2	4

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

*U.S.Government Printing Office: 1982 — 559-007/8028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